

OPENING THE FRONT DOOR

A NEW APPROACH TO SPACE TECHNOLOGY AND COMMERCIALIZATION

Remarks by
NASA Administrator Daniel S. Goldin
Washington Space Business Roundtable
November 10, 1992

Today I will talk to you about some exciting new ideas we have for dramatically improving the way NASA approaches the development and transfer of advanced technology, as well as our concept of commercializing space and space technologies.

Innovation is the great hallmark of America. The image of the lone inventor working in his lab or garage to perfect the cotton gin, the electric light, or the personal computer, is a potent symbol of what transformed the original 13 colonies into the greatest nation on earth.

Developing new technology is what drives this country forward. It raises our standard of living by creating the new industries and new jobs of tomorrow. I believe America today is crying out for organizations like NASA to step up to the challenge of developing cutting edge dual use technology that can both keep America pushing outward into space and put Americans back to work.

NASA can be a leading force for creativity, innovation, and boldness in American society just as we did during the days of Apollo, when America reigned supreme in the world of technology because we were on the cutting edge.

While we can learn from the past, the 90s are different than the 60s, and NASA needs to change with the times. That's why we are starting something new. In creating the Office of Advanced Concepts and Technology, we are not simply stapling together the old Commercial Programs and Space Technology offices. This will be an entirely new breed -- a highly flexible, customer-driven organization that will develop innovative concepts and high leverage technology that both fulfill NASA's needs and have significant commercial possibilities.

As we currently envision it, this new office will have three primary functions that will satisfy some currently unmet needs. First, we will set up a highly professional systems engineering team capable of detailed feasibility and cost analysis of advanced concepts.

Currently, there is no place in NASA where someone with an advanced concept can go to get their idea properly considered and evaluated. Furthermore, in the rush to "bend metal," there is usually little consideration of operations or life cycle costs.

There is so much specialization in the engineering and scientific disciplines that when it comes time to integrate individually developed subsystems, the task is enormously complicated and expensive. The systems engineering function will also help bridge the gap between technology development and real world applications so we avoid ending up with "hobby shops" that aren't aligned with customers' needs while commercial opportunities fall by the wayside.

Second, we want this new office to be NASA's "front door" to businesses who want NASA's help and expertise in developing new ideas and technologies. Currently, people who bang on our door with commercial opportunities too often end up banging their heads against the wall as they get shuffled from center to center and program to program. Our new office will provide one-stop shopping for technology customers and suppliers -- whether they are businesses or universities, or even program offices inside of NASA.

Let me give you some purely hypothetical illustrations of how this could work. For example, micromachines and microdevices offer the promise of conducting complex operations with a tiny fraction of the power, weight, and volume required with more conventional approaches. Suppose, for example, we challenge our planetary scientists to come up with some inexpensive micro-rovers. They would then go to the Office of Advanced Concepts and Technology as customers seeking microdevices and other technologies to save weight and cut launch costs.

An example of an outside customer might be a business with an idea to increase the performance and cut the cost of a rocket motor. They could work out some kind of arrangement so that both NASA and the private sector would benefit from the new technology. Or perhaps a small or disadvantaged firm that makes thermoplastics seeks NASA's help in developing a new manufacturing technique.

We could develop a partnership whereby the firm receives technical expertise that improves their product line, while NASA receives new lightweight materials for our own use at a lower cost. Such a win-win approach would enhance NASA's programs, yield more value for the taxpayer, and improve the economy generally by helping the private sector become more competitive.

Third, the Office of Advanced Concepts and Technology will be our place to transfer technology into the commercial sector. We will seek the input of the technology user community to figure out the best transfer mechanisms, whether it's technical papers, NASA-generated software, regional tech transfer centers, cooperative research agreements, or working in our labs and other facilities.

The Centers for the Commercial Development of Space is just one example of the type of highly innovative public/private arrangements that may emerge from this new organization.

I have challenged Greg Reck and Courtney Stadd to think broadly and creatively in developing an organizational structure that is flexible, not hierarchical, so it can be highly responsive to new opportunities, new breakthroughs, and be customer-driven.

We want to abolish the "not invented here" syndrome which breed insularity and fails to seize the good ideas within and outside of NASA. We'd like to create a highly efficient management structure with a flat organizational chart that hopefully will become a model of non-bureaucracy for other government agencies to emulate.

Greg and Courtney have created a culturally diverse process action team made up of a broad cross-section of NASA to make recommendations on the offices's functions and structure. They plan to have a first draft done in December. They are also developing a plan to schedule forums around the country to reach out to all the various constituencies that have a stake in this new office -- both aerospace and non-aerospace industries. We are also openly competing and advertising for the top jobs in this new office so we can get the best people in America.

If what I've described here today sounds a bit vague, it is. This is a "work in progress." So what I encourage you to do is interact with us as we proceed. You can weigh in with your ideas on what you'd like to Ana Villamil at 358-1999. Greg and Courtney would welcome your input.

For everyone who's worried about the American economy being stuck in a rut, it's vital that we remember the tremendous power of technology to produce growth. Remember the tremendous push NASA gave to the computer chip and software sector.

NASA pioneered fault-tolerant software and vast computer networks over long distances, building a trained workforce that went out and created a whole new industry, not to mention how satellites have revolutionized telecommunications, providing live TV anywhere in the world and inexpensive long distance service.

Other important new technologies are appearing on the horizon that could totally transform the way we work in space, and hold the promise of astounding commercial applications.

Virtual reality may enable us to experience the sensations of exploring distant planets without leaving Earth, and to build incredibly realistic trainers and simulators that have the added benefit of being reprogrammable. Virtual reality's cousin -- telepresence -- could allow us to conduct remote operations in space, or hazardous environments on Earth as if we were there.

Another new focus of our technology program will be to lower the weight and cost of spacecraft, including plastics and ceramic materials, microsensors, artificial intelligence on board spacecraft, and integrated opto-electronics for controls and navigation.

Beyond NASA's applications of such new capabilities, it's easy to envision many commercial applications as well. In the aerospace industries, these technologies can improve our global competitiveness in communications satellites and other spacecraft.

In other sectors, these technologies could be employed to create new non-invasive medical sensors, or new materials to improve the fuel efficiency of automobiles.

To give America the full use of what NASA develops, we must be aggressive in moving technology much faster into the general economy.

The true test of NASA as a jobs generator is not how many people are working for NASA, but how many people are working because of NASA -- because of NASA's ability to reach out into the future to bring back answers for today.

As we consider where we are and where we're going after 35 years of traveling to the final frontier, it's useful to recall the development of America's Western frontier.

Right now, I believe we're like President Jefferson hearing the report of Lewis and Clark, who had looked around, made some maps, and brought back some interesting minerals, flora and fauna.

But now it's time to send out the fur trappers and 49ers, the pioneers and conestoga wagons. We need to build the trading posts, string the telegraph wires, and lay down the railroad tracks. There is plenty of work to be done by government and the commercial sector, as well as universities, to tame and develop the frontier of space.

But like the American West, outer space is welcoming us -- almost calling us -- as a place to generate new wealth, and just as important, to renew our spirit as Americans - as the greatest pioneering nation on Earth.

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CREATING THE OFFICE OF ADVANCED CONCEPTS AND TECHNOLOGY
WASHINGTON SPACE BUSINESS ROUNDTABLE
REMARKS BY NASA ADMINISTRATOR DANIEL S. GOLDIN
TUESDAY, NOVEMBER 10, 1992

Before I start, I'd like to share an experience that we at the NASA team had yesterday. We had the first in a series of Town Meetings. This one happened to take place in Raleigh/Durham, NC, and we went out there with some trepidation. We did some peer review of what this Town Meeting might be. Instead of going out with the usual pitch where we told everybody how wonderful NASA was, we went out and told them we were undergoing a self examination. We're really looking at ourselves and we were going to tell them what we thought we did well, where we had some problems, and we even showed them a video that the employees made for internal consumption.

There was great anxiety among the forecasters of doom and gloom that the American public wasn't strong enough to really understand all the things they read in the press. But I am pleased to say that it was a wonderful meeting. We had about two hours worth of comments from the general public, and the sense I had when I left was that the people of Raleigh/Durham really appreciate the space program. They had some really positive things to say about it. And I think we, in NASA, learned a lot by not being afraid and telling them how the world was, not how we'd like it to be. And I think if we keep this up in the next cities we're going to go to, we're going to end up with a strategic plan that's just outstanding. So, next Tuesday is Hartford, next Friday is Indianapolis, and so on and so forth. It's very, very encouraging.

There was a young man who stood up. He said, "I have no comments to make, but let me show you my license plate. And the license plate said "GO NASA." It was really good vibes. We had a panel made up of the Associate Administrators. When they got done there were 12-14 people that wanted to talk to them. So we ended up getting out about an hour late. But I am just really excited about the possibilities, and we're just going to keep this going. And I think we're going to learn a lot.

Today I will talk about a very specific subject. Before I do that, let me thank Bill Shick for introducing me. And it's a pleasure to be here today.

Today I'm going to talk about some exciting new ideas we have for dramatically improving the way NASA approaches the development and transfer of advanced technology as well as our concept of commercializing space and space technologies. I'll come back to it later.

My point is NASA would love to commercialize space--not privatize space for people who want to sell NASA goods and services--but commercialize space., and as soon as it becomes market-driven, cut the umbilical cord with pride and then watch it grow. That is where we're going, and I'll come back to that in a little while.

Innovation is the great hallmark of America. The image of the lone inventor working in his or her lab or garage to perfect the cotton gin, the electric light, or the personal computer, is a potent symbol of what transformed the original 13 colonies into a 5.5 trillion dollar gross national product.

Developing new technology is what drives this country forward. It raises our standard of living by creating the new industries and new jobs of tomorrow. I believe America today is crying out for organizations like NASA to step up to the challenge of developing cutting edge, dual-use technology that can keep America pushing outward into the solar system and the stars, and provide new industries and new jobs and put Americans back to work. We must always look at dual-use technology.

NASA can be a leading force for creativity, innovation, and boldness in American society just as we were during the days of Apollo, when America reigned supreme in the world of technology because we were on the cutting edge--taking risks, and not playing it safe to guarantee a multi-billion dollar program will survive in the Congress.

While we can learn from the past, the 90s are different than the 60s, and NASA needs to change with the times. That's why we've started something new. In creating the Office of Advanced Concepts and Technology, we are not simply stapling together the old Commercial Programs and Space Technology offices out of Code R.

This organization will be an entirely new breed--a highly flexible, customer-driven, and underline customer-driven ten times, organization that will develop innovative concepts and high leverage technology that both fulfill NASA' s needs and have significant commercial capabilities.

As we currently envision it, this new office will have four primary functions that will satisfy some currently unmet needs. First, we will set up a highly professional systems engineering team capable of detailed feasibility and cost analysis of advanced concepts.

Currently, there is no single place in NASA where an individual with an advanced concept can go to their idea properly considered and fairly evaluated. Furthermore, in the rush to "bend metal" there is usually little consideration of operations or total life cycle costs.

When we go the Congress, we present Congress with the bill for the development costs, and then, after we're going, we slide in the M&O costs and all of the other things, and we find that the total program cost is sometimes three times the development cost and then we get all hung up because we never have any money to start anything new because everyone always reminds us--"Oh, Mr. Goldin, you forgot about the fact that we only have a year and a half worth of operations, but we have a ten year mission. Too bad--nothing new."

There is so much specialization in the engineering and scientific disciplines that when it comes time to integrate individually developed subsystems, the task is enormously complicated and expensive. The systems engineering function will also help bridge the gap between technology development and real world applications so we avoid ending up with "hobby shops" that aren't aligned with the civil space customers inside of NASA nor with the commercial opportunities and the real user market, American industry for commercial applications.

Second, we want this office to be NASA's "front door" to businesses and universities who want our help and expertise in developing new ideas and technologies. Currently, people who knock on our door with commercial opportunities too often end up banging their heads against the wall as they get shuffled from center to center and program to program. Our new office will provide one-stop

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Let me give you some purely hypothetical illustrations of how this could work. For example, micromachines and microdevices offer the promise of conducting complex operations with a tiny fraction of the weight, power, volume and cost required with the more conventional approach. Suppose, for example, we challenge our planetary scientists (which we will) to come up with some inexpensive micro-rovers. They would then go to the Office of Advanced Concepts and Technology as customers seeking microdevices and other technologies to save weight and cut launch costs.

Industry, academia, small entrepreneurial companies, other government laboratories, and yes, even, some of the NASA centers, can be the resource for providing this microrover or microdevice. It is not given that, because a given NASA center does something, they have infinite knowledge of that technology. We are reaching out to all of America to trigger the very best that we have in the country.

An example of an outside customer might be a business with an idea to increase the performance or cut the cost of a furnace on Space Station Freedom. They could work out some kind of arrangement so that both NASA and the private sector could benefit from the new technology.

Or perhaps a small, disadvantaged business firm that makes thermoplastics seeks NASA's help in developing a new manufacturing technique. We could develop a partnership with that small firm, whereby the firm receives technical expertise that improves their product line, while NASA receives new lightweight materials for our own use at a lower cost. Such a win-win approach would enhance NASA's programs, yield more value for the taxpayer, and improve the economy generally by helping the private sector become more competitive.

Third, the Office of Advanced Concepts and Technology will be our place to transfer technology into the commercial sector. And by the commercial sector we don't mean the intermediate or interface companies, we mean the companies that actually work on the product. We will seek the input of the technology user community to figure out the best transfer mechanisms, whether its a technical

paper, a cooperative agreement, NASA-generated software, regional tech transfer center, or working in our labs or in our facilities. And let me give you an example of where we could apply water on the parched desert.

NASA builds critical software, critical to human life so we have designed that software to be error free. Think of the applications in society, where if we really put our minds to it, we could just enable American industry where there's life-saving or critical process activity where we could just transfer that software technology and all of a sudden America has an edge in the world. We uniquely have this software. No other country in the world has this error-free software that we have.

I was down at the research technology institute in Raleigh, NC yesterday and I visited with some of those wonderful people. They have a program that I think is just a model of what can be done. But we have anecdotal material. We don't have anything we can measure. But let me give you a few anecdotes and then we can let our minds wander to see where it can go.

NASA has transferred eximerlaser technology to the medical community so they can do eximerlaser angioplasty. That procedure costs \$6,000 and is relatively non-intrusive as compared to open heart surgery which is very risky and costs \$25,000. Three thousand people have had the benefit of excimerlaser angioplasty. Think of the possibilities. Now we don't even keep track of the savings we have and one of the things that I challenged them at RPI yesterday was, don't just tell me anecdotes. Come up with a process where we can actually measure, in real terms, for every investment dollar that NASA makes, how much we return to the economy and then track all this through and don't do a little piece here and a little piece there. We need an integrated program. And that's what I'm challenging these two gentlemen to do. We don't want anecdotes next year, we want a measure to so how we're doing.

There's a fourth category, and I wrote this and rewrote this, and I just rewrote it again as I came to dinner, because it's the most difficult category. This is the category called commercialization of space. I don't want to make any negative comments because a lot of good people have spent a lot of time, but I think if we objectively take a look and see where we are today, in the commercialization of space, not the privatization of having people get 100% of the launch

services from NASA, or get the lockers on the Space Shuttle for NASA, but commercialization of space. The only thing we can really say has been an outstanding success is the commercial communications.

We have to find ways of commercializing space and I view this as the biggest challenge of this organization and I'll give you an example of what I mean. I went down and I gave the speech and they said, "Mr. Goldin you drew 700 people in Huntsville, AL," the conference I went to was the Space Station Freedom Utilization conference. Over six hundred people were there. It was a wonderful, wonderful luncheon until I said, "How many people here are users, real users of the Space Station?" Not the people that build the aluminum and steel and plastic, but the people that actually use it. Of 700 people in that room, two dozen people stood up. This is an inverted pyramid. And this is the problem of Space Station Freedom. We do a wonderful job of building it, but we do not have the utilization community set up. And we have the cart before the horse. Let me tell you we have a very short time to go get that problem fixed.

Now there is a tremendous set of possibilities and the folks over in Code S have been doing a super job, but we, in the front office, but have not been supporting them in building the utilization activity in station and bringing in the community. And I don't mean people in universities, because I view the people at universities as the interface people. The people that are going to utilize Space Station Freedom are the pharmaceutical companies, the biomed companies, the biotech companies, the semiconductor companies, the material companies. They are the users. At conference after conference we have tremendous turnout because the people who are part of the NASA jobs program come, but the people that utilize the NASA technology are not connected into us and we delude ourselves when we have all these meetings and we talk to ourselves.

It is absolutely critical that we cut this Gordian knot and call it for what it is. We have got to do it. Now, towards that end, Marty Kress was appointed the Deputy Manager of the Space Station Freedom program, and Marty's job is to make sure he work's with Courtney Stadd and Greg Reck to bring in the utilization community so that we have a true user community. SSF is going to be the most wonderful thing that every happened to our country. But right now

its a deep, dark secret, and that secret has to be shared with the American industry, and the American medical profession.

We went to the AMA and we talked to them. There was a tremendous lack of knowledge on the part of the AMA as to what NASA has done for the medical community in America. In talking to physicians, they say, well, why should we work with NASA? They say, "we could compete for funds for the budget." And I said to them, you don't understand. If NASA were to be eliminated today, you wouldn't know it, and ten years from today, there would be a silent death, because all the instrumentation, all the medical equipment that quietly, privately, gets transferred from NASA to American medical industry would slowly disappear. You will not see a CT scan, a PET scan, an MRI. You'll not have digital heart imaging, or bubble angioplasty, you won't have eximerlaser angioplasty, you will not have bladder fullness detectors, and I could go on and on. But the fact of the matter is, this is kind of just happening, it's not being managed. And I submit that we get \$14 billion a year, we cannot be an anecdotal material, we've got to manage the process--and that's the purpose of this new organization. And they are going to be in charge. And there are five different empires at NASA that are going to vaporize. Now the barricades are up in the streets, and they are very unhappy campers because they say Goldin doesn't believe in TQM. Goldin believes in TQM, he doesn't believe in a jobs program and building empires. Let me assure you of that. We're going to have a process action team work this all out. But we're going to have real commercialization in space.

I believe there are three categories that we should look at. There's near-term, and let me give you an example of what I believe is real commercialization of space--at least, high focus-high risk--the wake shield. The University of Houston and their contractor ought to be given the national medal of honor for what they're doing. Twelve million dollars is the most unbelievable bargain this nation ever got in stimulating a new industry. They've done a complete value analysis. They looked at product improvement, the possibility of getting the purity of space, to get faster switching speeds in building of gallium arsenide semi-conductors. They looked at the amount of material going up, the amount of material going down, and how the increase of product value would go. That goes up in the Shuttle on November 17, 1993. It is a world-class event. Charlie Bolden is leaving us on December 1. He will be the crew chief. We have one of the Russians flying up there with him. We have a crew and the

whole world ought to watch that for me. That's going to be one of the major new first commercial experiences in the commercialization of space. And that's near-term.

Mid-term, I think that we have to look at SSF at the turn of the century as being one of the most incredible facilities for commercializing space. Towards that end we have to put our hearts and souls to it to assure that we do the right thing.

There's another area where NASA is making a huge investment and I think we are not addressing the commercialization of space. We have one of our most important programs--Mission to Planet Earth--we're running off to the scientific community and the scientific community is telling NASA what we have to do. Why have we not talked to American industry to see what they think we ought to be doing with Mission to Planet Earth? God only knows we need more resources. God only knows we have to do a better job of managing our crops and pollution on the ground. We're not talking to American industry. The scientific community, and don't get me wrong, I think they're doing a good job, but there is an imbalance between the what the scientific community does in setting NASA's requirements and how NASA looks to industry. And, once again, the barricades are up in the streets. But that's the way the world is going to go. We've got to bring America's industry into NASA's programs. We've got to bring academia into NASA's programs, not the people that benefit from the dollars that flow from NASA, but the people that will use the research that will go into the industry. And again, NASA must be weaned from being a jobs program, into being a program that will get America number 1 in competitiveness. It's very stressful. It's not enjoyable, saying this, but let me tell you, this is what has to occur.

So mid-term, we have got to get Mission to Planet Earth and SSF intimately involved with American industry.

Long-term, and now you have to take out your thinking caps, we have exploration. We're not going to spend billions and billions on exploration in the next few years, but what we are going to do is quietly formulate plans as to where we might be 10, 20, 30 years from now, and wouldn't it be refreshing if we talked to American industry, entrepreneurial firms and large industries and resources and say, we want to have a mission to a near-earth asteroid. That

near-earth asteroid might be a resource for future for precious metals.

Why don't you work with us now in the planning process so we don't just pay attention to the science so that people can write a bunch a papers and have some fun. Why don't you work with us so that we can really get together and address the requirements for that mission so it makes a little bit of sense.

So I put it into those three categories. What is our goal? Let me state the goal right off the bat. That is to promote market driven applications and then cutting the umbilical cord not to fund people for decades so they can be privatizing work with NASA.

That is the goal and that is the objective of the commercial activity that we set forth for this Advanced Concepts and Technology organization.

I have challenged Greg Reck and Courtney Stadd, they have the uncomfortable position of being the Acting Associate Administrator and Acting Deputy Associate Administrator for the new organization. I challenged them to think broadly and creatively in developing an organizational structure that is flexible, not hierarchical, so it can be highly responsive to new opportunities, new breakthroughs, and, most of all, be customer driven. Not be driven by the NASA bureaucracy, not being driven as being a separate organization that competes for funds with other organizations with NASA. But being driven by the customer--American industry and the American public.

We want to abolish the "not invented here" syndrome which breeds insularity and fails to seize the good ideas within and outside of NASA. W'd like to create a highly efficient management structure with a flat organizational chart that hopefully will become a model of non-bureaucracy for other government agencies to emulate.

Greg and Courtney have created a culturally diverse process action team made up of a broad cross-section of NASA to make recommendations on the office's functions and structure.

They plan to have a first draft done of this new plan in December. They are also developing a plan to schedule forums around the country to reach out to all the various constituencies that have a stake in this new office--and I wish you well because I have been traveling around the country. I'm a little tired today. Both aerospace and non-aerospace industries and academia are welcome. We are also openly competing these two jobs and all other jobs that are being created by this restructuring in this new office so we can get the very best America has to offer. And I'm not saying that these two gentlemen aren't the best, but we're opening it up to America.

If what I've described here today sounds a little bit vague, this is a "work in progress," this isn't a finished product. So what I encourage you to do is interact with us as we proceed.

You can weigh in with your ideas on what you'd like to Ana Villamil at 358-1999. Greg and Courtney welcome your support.

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NASA pioneered fault-tolerant software and vast computer networks over long distances, building a trained workforce that went out and created whole new industries, not to mention how satellites have revolutionized telecommunications, providing live TV anywhere in the world and inexpensive long-distance phone calls.

Other important new technologies are appearing on the horizon. By the way, for those of you that are a little bit younger, I'll recite an experience. I talked to the young people at the Daniel School in Raleigh yesterday. I was telling them that when I was their age, 12 years old, I made a phone call to my aunt in Iowa with my parents once a year because it was so terribly expensive and such a large fraction of our budget. So for those of you not old enough not to remember those days, don't take for granted, our modern telephone system and the role that NASA played in making it very inexpensive to casually call someone across the country or across the world.

Other new technologies are appearing on the horizon that could totally transform the way we work in space, and hold the promise of astounding commercial applications.

Virtual reality may enable us to experience the sensations of exploring distant planets without leaving Earth, and to build incredibly realistic trainers and simulators that have the added benefit of being reprogrammable. Virtual reality's cousin--telepresence--could allow us to conduct remote operations in space, or hazardous environments on Earth as if we were there.

Think of the possibilities of driver's training 101 in high school where students hop into virtual reality and bang up a computer instead of their parent's car. It's happened to me twice.

But think about it, we could have drivers that could skid on ice, drivers that could experience a car coming at them for a head-on collision. And think of the lives we'll save and industry will generate in building a virtual reality terminal that could touch every new driver in this country, and for that matter, around the world. And then let your mind wander about training people that have hazardous operations--crane operators, truck drivers, nuclear system operators. We could generate just with this virtual reality which is being developed at NASA/Johnson a whole new industry. The problem is we're focusing on space. And we're not having this dual-use coming out of each eye, saying "by God we're not going to spend a nickel on space til we think about the virtual reality terminal for the teenagers of America." That's the way we have to start thinking and that's what I've challenged this new organization to do.

Another new focus of our technology program will be to lower the weight and cost of spacecraft, including plastics and ceramic materials, microsensors, and expert systems for onboard the spacecraft, and integrated opto-electronics for controls and navigation.

Beyond NASA's applications of such new capabilities, it's easy to envision commercial applications as well. The aerospace industries these technologies can improve are global competitiveness and biotech, semi-conductors, resource development, resource management, these are all very, very, critical industries. Biotech will probably grow by an order of magnitude by the next decade. NASA can help contribute to that rapid growth and even accelerate it and

take it beyond belief in the decade afterwards when SSF really kicks in.

Furthermore, we can improve standard products or develop new ones through space research where we understand combustion processes, condensation. We just did a validation, hopefully--we don't have the final data--of a Nobel Prize-winning group theory which will allow us to handle phase transitions. We did it on Space Shuttle Columbia in spite of all the criticism that said we didn't have anything of value on that Space Shuttle.

To give America the full use of what NASA develops we must be aggressive in moving technology must faster into the general economy.

The true test of NASA as a jobs generator is not how many people are working for NASA or NASA contracts, but how many people are working because of NASA--because of NASA's ability to reach out into the future to bring back the answers for today.

As we consider where we are and where we're going 35 years of traveling to the final frontier, it's useful to recall the development of America's western frontier.

Right now, I believe, we're like President Jefferson, hearing the report of Lewis and Clark, who had looked around, made some maps and brought back some interesting minerals, flora and fauna.

But now it's time to send out the fur trappers and 49ers, the pioneers and the conestoga wagons. We need to build trading posts, string the telegraph wires, and lay down the railroad tracks. There is plenty of work to be done by government and the commercial sector, as well as universities, to develop and tame the space frontier.

But like the American West, outer space is welcoming us--almost calling us--as a place to generate new wealth, and just as important, to renew our spirit as Americans--as the greatest pioneering nation on Earth.

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ROUNDTABLE
LOEWS L'ENFANT PLAZA
TUESDAY, NOVEMBER 10, 1992**

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While we can learn from the past, the 90s are different than the 60s, and NASA needs to change with the times. That's why we are starting something new. In creating the Office of Advanced Concepts and Technology, we are not simply stapling together the old Commercial Programs and Space Technology offices. This will be an entirely new breed -- a highly flexible, customer-driven organization that will develop innovative concepts and high leverage technology that both fulfill NASA's needs and have significant commercial possibilities.

As we currently envision it, this new office will have three primary functions that will satisfy some currently unmet needs. First, we will set up a highly professional systems engineering team capable of detailed feasibility and cost analysis of advanced concepts.

Currently, there is no place in NASA where someone with an advanced concept can go to get their idea properly considered and evaluated. Furthermore, in the rush to "bend metal," there is usually little consideration of operations or life cycle costs.

There is so much specialization in the engineering and scientific disciplines that when it comes time to integrate individually developed subsystems, the task is enormously complicated and expensive. The systems engineering function will also help bridge the gap between technology development and real world applications so we avoid ending up with "hobby shops" that aren't aligned with customers' needs while commercial opportunities fall by the wayside.

Second, we want this new office to be NASA's "front door" to businesses who want NASA's help and expertise in developing new ideas and technologies. Currently, people who bang on our door with commercial opportunities too often end up banging their heads against the wall as they get shuffled from center to center and program to program. Our new office will provide one-stop shopping for technology customers and suppliers -- whether they are businesses or universities, or even program offices inside of NASA.

Let me give you some purely hypothetical illustrations of how this could work. For example, micromachines and microdevices offer the promise of conducting complex operations with a tiny fraction of the power, weight, and volume required with more conventional approaches. Suppose, for example, we challenge our planetary scientists to come up with some inexpensive micro-rovers. They would then go to the Office of Advanced Concepts and Technology as customers seeking microdevices and other technologies to save weight and cut launch costs.

An example of an outside customer might be a business with an idea to increase the performance and cut the cost of a rocket motor. They could work out some kind of arrangement with so that both NASA and the private sector would benefit from the new technology. Or perhaps a small or disadvantaged firm that makes thermoplastics seeks NASA's help in developing a new manufacturing technique.

We could develop a partnership whereby the firm receive technical expertise that improves their product line, while NASA receives new lightweight materials for our own use at a lower cost. Such a win-win approach would enhance NASA's programs, yield more value for the taxpayer, and improve the economy generally by helping the private sector become more competitive.

Third, the Office of Advanced Concepts and Technology will be our place to transfer technology into the commercial sector. We will seek the input of the technology user community to figure out the best transfer mechanisms, whether it's technical papers, NASA-generated software, regional tech transfer centers, cooperation research agreements, or working in our labs and other facilities.

The Centers for the Commercial Development of Space is just one example of the type of highly innovative public/private arrangements that may emerge from this new organization.

I have challenged Greg Reck and Courtney Stadd to think broadly and creatively in developing an organizational structure that is flexible, not hierarchical, so it can be highly responsive to new opportunities, new breakthroughs, and be customer-driven.

We want to abolish the "not invented here" syndrome which breed insularity and fails to seize the good ideas within and outside of NASA. We'd like to create a highly efficient management structure with a flat organizational chart that hopefully will become a model of non-bureaucracy for other government agencies to emulate.

Greg and Courtney have created a culturally diverse process action team made up of a broad cross-section of NASA to make recommendations on the offices's functions and structure.

They plan to have a first draft done in December. They are also developing a plan to schedule forums around the country to reach out to all the various constituencies that have a stake in this new office -- both aerospace and non-aerospace industries. We are also openly competing and advertising for the top jobs in this new office so we can get the best people in America.

If what I've described here today sounds a bit vague, it is. This is a "work in progress." So what I encourage you to do is interact with us as we proceed.

**You can weigh in with your ideas on what you'd like to Ana Villamil at 358-1999. Greg and Courtney would welcome your input. **

For everyone who's worried about the American economy being stuck in a rut, it's vital that we remember the tremendous power of technology to produce growth. Remember the tremendous push NASA gave to the computer chip and software sector.

NASA pioneered fault-tolerant software and vast computer networks over long distances, building a trained workforce that went out and created a whole new industry, not to mention how satellites have revolutionized telecommunications, providing live TV anywhere in the world and inexpensive long distance service.

Other important new technologies are appearing on the horizon that could totally transform the way we work in space, and hold the promise of astounding commercial applications.

Virtual reality may enable us to experience the sensations of exploring distant planets without leaving Earth, and to build incredibly realistic trainers and simulators that have the added benefit of being reprogrammable. Virtual reality's cousin -- telepresence -- could allow us to conduct remote operations in space, or hazardous environments on Earth as if we were there.

Another new focus of our technology program will be to lower the weight and cost of spacecraft, including plastics and ceramic materials, microsensors, artificial intelligence on board spacecraft, and integrated opto-electronics for controls and navigation.

Beyond NASA's applications of such new capabilities, it's easy to envision many commercial applications as well. In the aerospace industries, these technologies can improve our global competitiveness in communications satellites and other spacecraft.

In other sectors, these technologies could be employed to create new non-invasive medical sensors, or new materials to improve the fuel efficiency of automobiles.

To give America the full use of what NASA develops, we must be aggressive in moving technology much faster into the general economy.

The true test of NASA as a jobs generator is not how many people are working for NASA, but how many people are working because of NASA -- because of NASA's ability to reach out into the future to bring back answers for today.

As we consider where we are \ and where we're going after 35 years of traveling to the final frontier, it's useful to recall the development of America's Western frontier.

Right now, I believe we're like President Jefferson hearing the report of Lewis and Clark, who had looked around, made some maps, and brought back some interesting minerals, flora and fauna.

But now it's time to send out the fur trappers and 49ers, the pioneers and conestoga wagons. We need to build the trading posts, string the telegraph wires, and lay down the railroad tracks. There is plenty of work to be done by government and the commercial sector, as well as universities, to tame and develop the frontier of space.

But like the American West, outer space is welcoming us -- almost calling us -- as a place to generate new wealth, and just as important, to renew our spirit as Americans -- as the greatest pioneering nation on Earth.

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